

Frameless

Volume 2
Issue 1 *Volume 2, Issue 1*

Article 22

2020

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Recommended Citation

Padhye, Snehal and Ferwerda, James (2020) "Digital Modeling Of Cultural Heritage Objects," *Frameless*: Vol. 2 : Iss. 1 , Article 22.

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Digital Modeling Of Cultural Heritage Objects

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Keywords—cultural heritage objects, digital modeling, realistic-rendering, interactive computer graphics.

Cultural heritage objects are a rich source of information about human history. Due to the physical nature of these often old and typically rare or unique objects, humanity is at risk of losing this history. Given their importance, preservation is an active area of interest in the research community. While, digitally capturing images of the objects is common practice, we propose a more comprehensive approach to preserving these objects. It involves creating digital models that represent both the three-dimensional shapes of the objects and the materials they are made of.

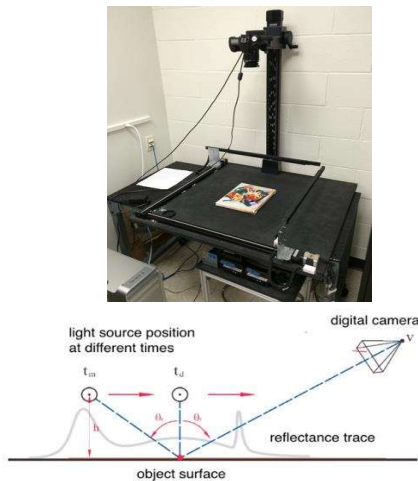


Fig. 1. Linear Light Reflectometer (top), and reflectance trace (bottom) used to model surface properties.

I. OVERVIEW

The basic idea is to capture sets of images in a defined illumination pattern and use these images as data to model the geometric (shape, texture) and radiometric (color, gloss, translucency) properties of the objects under consideration. Rendering these models using computer graphics creates realistic representations of the objects. Our current set up is shown in Fig. 1. It is a Linear Light Reflectometer (LLR) (based on earlier work by Gardner, Tchou, Hawkins, and Debevec 2003, 749-758); consisting of two linear light sources; that is used to capture images at different illumination angles. A sample result can be seen in Fig. 2.

To make these models accessible and easy to use, we have developed Web-based graphic applications that enable renderings of the models to be viewed in any browser from anywhere. These tangible display systems (Ferwerda 2013) do not require installation or maintenance of any custom package or software. The models can also be disseminated through the Web and visualized on standard mobile devices to provide rich, interactive access to digital collections of cultural heritage objects. Some examples of our systems are shown in Fig. 2.

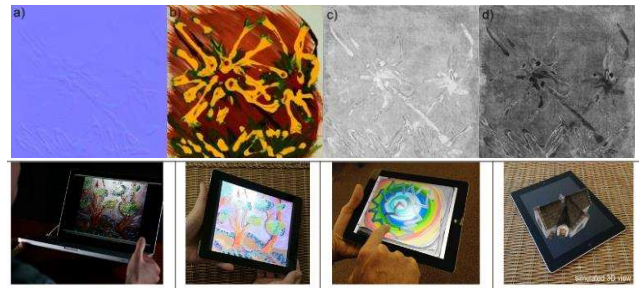


Fig. 2. Top - Surface normal(a) and (diffuse(b), specular(c) and roughness(d)) maps produced by the LLR. Bottom - Examples of Tangible Display Systems

II. CONCLUSION

Our system can be used to create interactive and realistic representations of cultural heritage objects. These systems can be used in libraries, museums and teaching platforms. This would reduce direct handling of the fragile documents, further adding value to their conservation.

Our goal ahead is to upgrade the system to reduce complexity to make it more practical to use. These improvements include reduction in number of images required to extract the material properties, a more portable capture system and extending it over non-planar cultural heritage objects.

III. REFERENCES

Gardner, A., Tchou, C., Hawkins, T., and Debevec, P. 2003. "Linear light source reflectometry." *ACM Transactions on Graphics (TOG)*, 22(3): 749-758.

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